Topic: Trigonometric derivatives

Question: Find the derivative of the trigonometric function.

$$y = \sin\left(3x^2 + 11x\right)$$

Answer choices:

A $y' = -\left(6x + 11\right)\cos\left(3x^2 + 11x\right)$

B $y' = -\left(6x + 11\right)\sin\left(3x^2 + 11x\right)$

C $y' = \left(6x + 11\right)\cos\left(3x^2 + 11x\right)$

D $y' = \left(6x + 11\right)\sin\left(3x^2 + 11x\right)$

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Solution: C

Make a substitution, letting $u = 3x^2 + 11x$ and $u' = 6x + 11$. Then $y = \sin u$, so

$$y' = \cos u \cdot u'$$

$$y' = \cos\left(3x^2 + 11x\right) \cdot \left(6x + 11\right)$$

$$y' = \left(6x + 11\right)\cos\left(3x^2 + 11x\right)$$

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Topic: Trigonometric derivatives

Question: Find the derivative of the trigonometric function.

$$y = 2 \sin x \csc 2x$$

Answer choices:

A $y' = \sec x \tan x$

B $y' = \sec x$

C $y' = \tan x$

D $y' = -\sec x \tan x$

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Solution: A

Use trigonometric identities to simplify the function.

$$y = 2 \sin x \csc 2x$$

$$y = 2 \sin x \frac{1}{\sin 2x}$$

$$y = 2 \sin x \frac{1}{2 \sin x \cos x}$$

$$y = \frac{1}{\cos x}$$

$$y = \sec x$$

Now we'll take the derivative, and get

$$y' = \sec x \tan x$$

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Topic: Trigonometric derivatives

Question: Find the derivative of the trigonometric function.

$$y = \cot^5 7x$$

Answer choices:

A $y' = -35 \csc^2 7x \cot^4 7x$

B $y' = -35 \csc^2 7x \cot^2 7x$

C $y' = -35 \csc^4 7x \cot^2 7x$

D $y' = -35 \csc^4 7x \cot^4 7x$

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Solution: A

Use power rule and chain rule.

$$y' = \frac{d}{dx}\left(\cot^5 7x\right)$$

$$y' = \frac{d}{dx}(\cot 7x)^5$$

$$y' = 5\,(\cot 7x)^4 \frac{d}{dx}(\cot 7x)$$

$$y' = 5\,(\cot 7x)^4 \left(-\csc^2 7x\right) \frac{d}{dx}(7x)$$

$$y' = 5\,(\cot 7x)^4 \left(-\csc^2 7x\right)(7)$$

$$y' = -\,35 \csc^2 7x \cot^4 7x$$

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